W. McCLAVE.

TURBINE BLOWER.

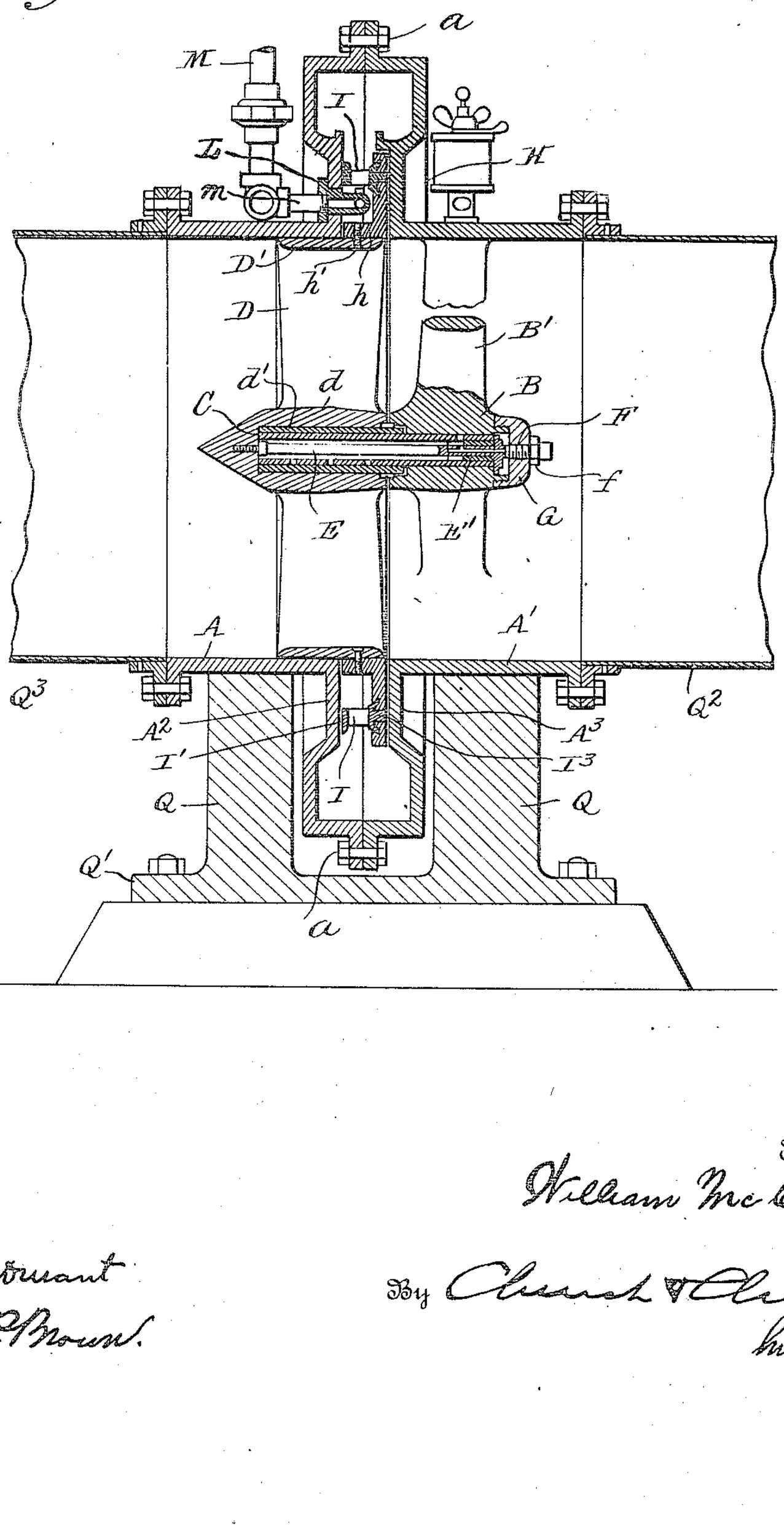
APPLICATION FILED JAN. 24, 1911.

998,709.

Patented July 25, 1911.

3 SHEETS—SHEET 1.

Fig. 1.



Witnesses

Thomas Durant

Talbot P. Brown.

Inventor

William McClave,

By Church & Church

his Attorneys

W. McCLAVE.

TURBINE BLOWER.

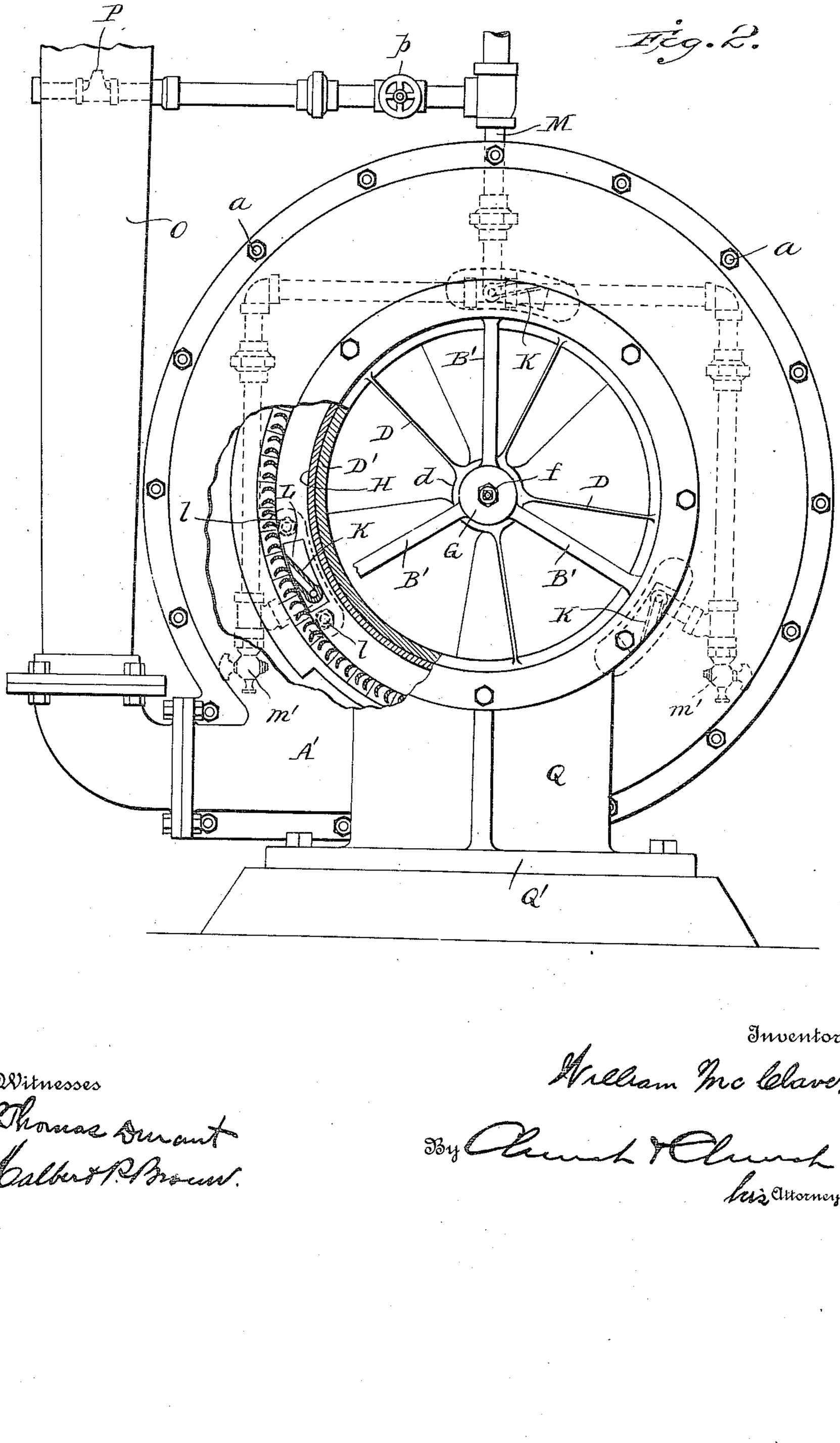
APPLICATION FILED JAN. 24, 1911.

998,709.

Patented July 25, 1911.

3 SHEETS—SHEET 2.

Fig. 2.



Witnesses

Thomas Durant

Walter P. Brown.

Inventor

William McClave,

By Church & Church

his Attorneys

W. McCLAVE.

TURBINE BLOWER.

APPLICATION FILED JAN. 24, 1911.

998,709.

Patented July 25, 1911.

3 SHEETS—SHEET 3.

Fig. 3.

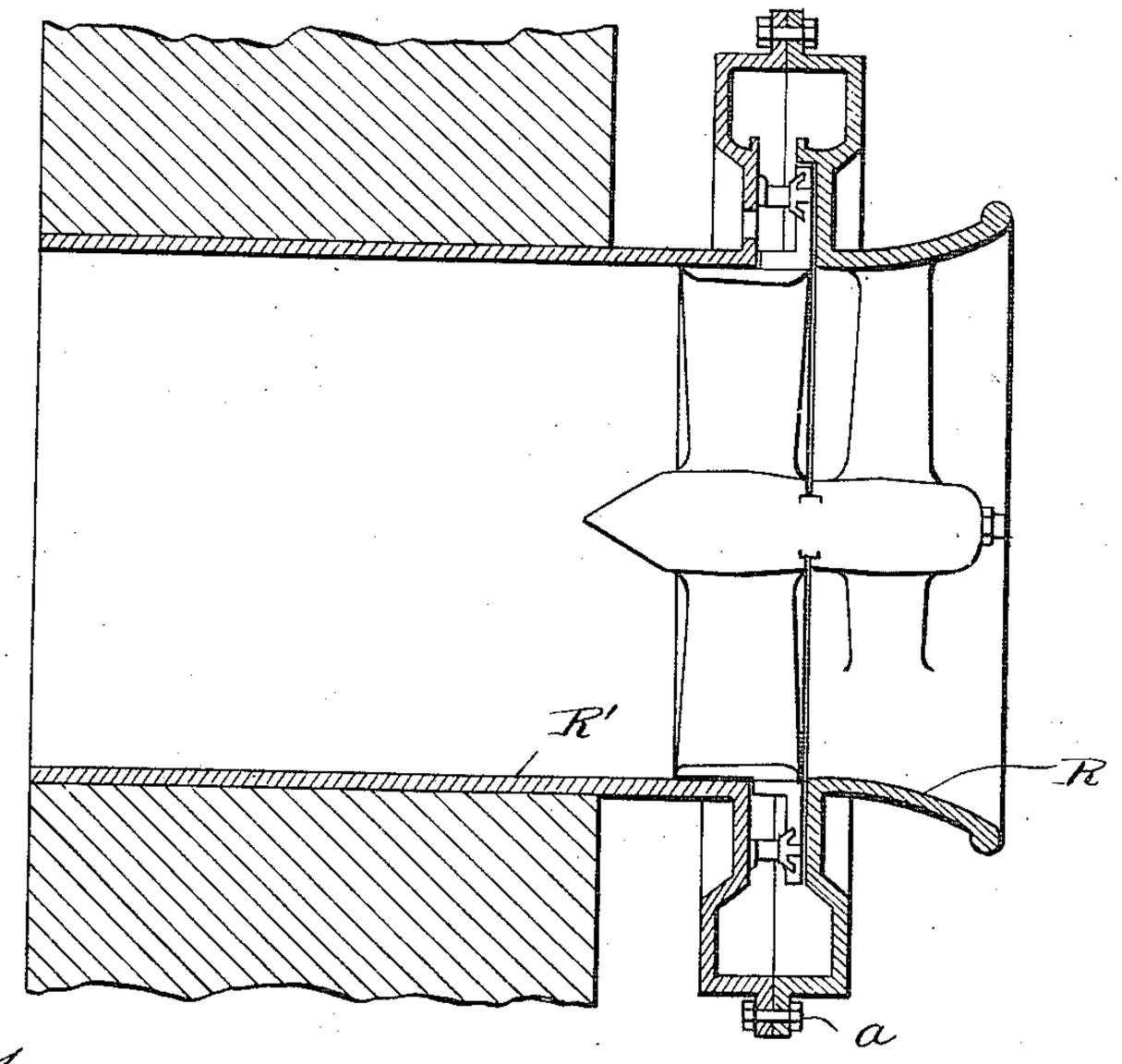


Fig. 4.

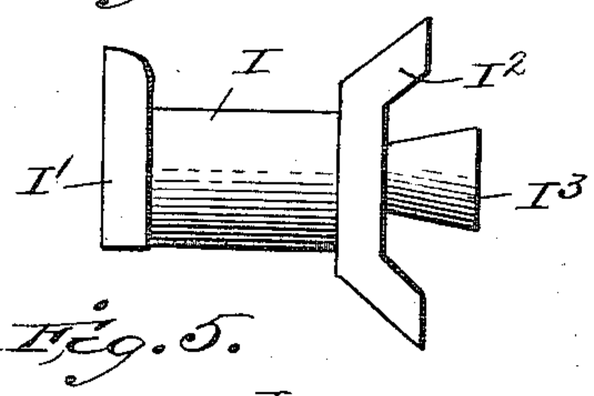


Fig. 5.

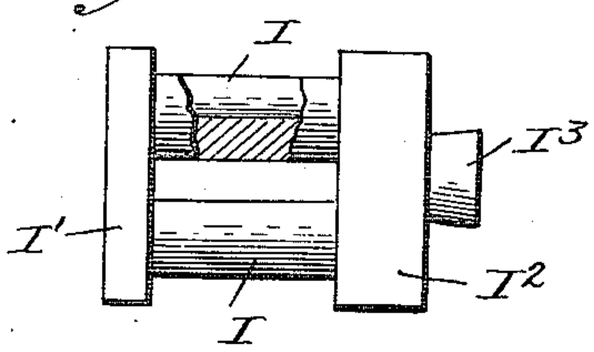


Fig. 6.

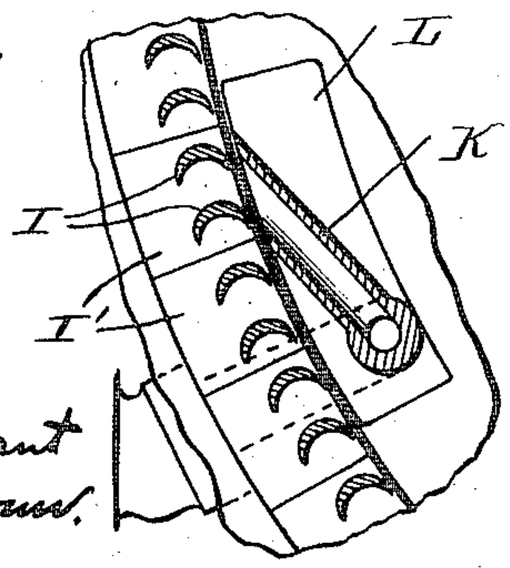


Fig. 7.

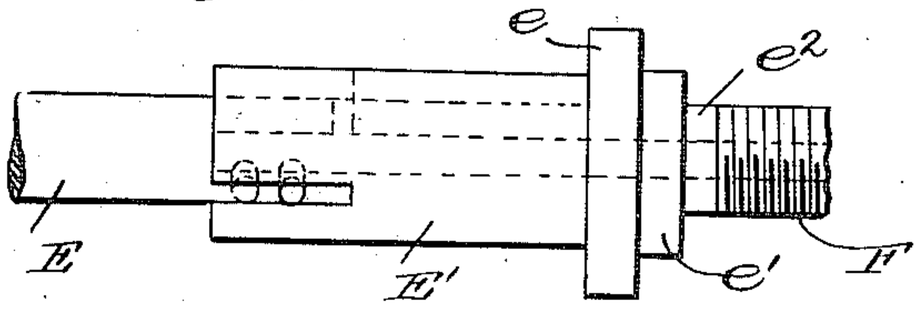


Fig. 8.

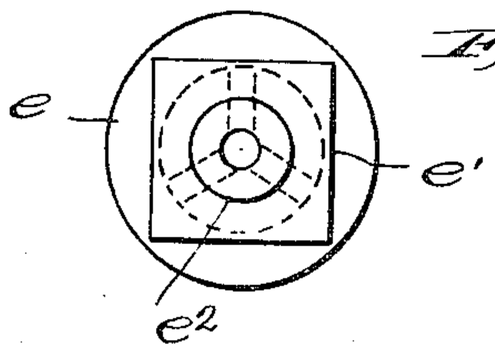
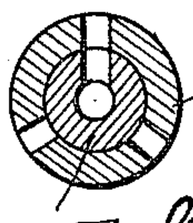


Fig. 9.



Witnesses

Thomas Durant

Halbert P. Brown.

Inventor

William McClave.

By Church & Church

their Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM McCLAVE, OF SCRANTON, PENNSYLVANIA, ASSIGNOR TO McCLAVE-BROOKS COMPANY, OF SCRANTON, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TURBINE-BLOWER.

998,709. Specification of Letters Patent. Patented July 25, 1911.

Application filed January 24, 1911. Serial No. 604,410.

To all whom it may concern:

Be it known that I, WILLIAM McCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Turbine-Blowers; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to air forcing apparatus, and more especially to that type of air forcing apparatus embodying a high speed rotary fan which is directly driven by the impact of an elastic fluid under pressure, against turbine buckets which are connected and rotate in unison with the fan itself.

The objects of the invention are to provide a simple and highly efficient apparatus adapted either for blowing or suction purposes and with which the air passing through the fan may be delivered free from the exhaust steam or other elastic driving fluid.

Other objects of the invention are to provide a structure which is susceptible of ready adjustment and which shall be capable of long and continuous use without the necessity of repair.

Referring to the accompanying drawings,—Figure 1 is a vertical section through a turbine blower embodying the present improvement; Fig. 2 is a front elevation of the blower shown in Fig. 1; Fig. 3 is a diagrammatic sectional elevation showing an arrangement of the casing and fan particularly adapted for use in supplying air to boiler furnaces; Figs. 4 and 5 are elevations, at right angles to each other, of a section of the ring of turbine buckets; Fig. 6 is a detail showing the arrangement of one of the jet nozzles; Fig. 7 is a detail elevation of the thrust bearing; Fig. 8 is an end elevation of the rotating thrust member; and Fig. 9 is a section through the same.

Similar letters of reference in the several figures indicate the same parts.

The turbine blower of the present invention embodies a casing which is preferably made sectional in order to provide for the more ready assembling of the parts. As shown, the casing is in two sections A and A′ having their meeting faces in a plane transverse to the axis of the fan and adapted to be connected together by peripheral bolts *a*. The casing as a whole is generally cylindrical in form and has an external exhaust chamber which when no fan and turbine is in place, communicates with the interior of the casing through an annular radial passage, in which passage the turbine buckets and jet nozzles are located, as will be presently pointed out. Conveniently, the exhaust chamber and passage are formed by radial flanges A^2 and A^3, which at their outer edges terminate in the joint faces of the two sections A, A′ of the casing.

One section of the casing, that indicated by the reference letter A′, is provided with a fixed internal axial hub B supported by radial arms B′, preferably three in number, as shown in Fig. 2. Said hub is adapted to support a tubular shaft C projecting forwardly or inwardly into the companion section of the casing A to form the journal for the blower fan D. The hub *d* of the latter, in the preferred construction, is chambered from the outer end, for the reception of a bushing or sleeve *d′*, which takes its bearing, or fits upon the tubular shaft or journal C. The hub *d* of the fan is tapered at its inner end and left solid whereby it presents no joints or openings and offers but little resistance to the closing in of the air after its passage through the fan. In order however to relieve the inner end of the shaft from wear due to the outward thrust of the fan, as well as to provide a means whereby the position of the fan longitudinally of its axis may be adjusted, a central rod or rotary thrust member E is secured at its inner end in the hub and passes outwardly or rearwardly through the hollow shaft C. At its outer end it is provided with a bearing shoulder or flange *e* (Fig. 7) adapted to bear on the outer end of the shaft so as to hold the fan against inward movement. Preferably, the movable thrust member E is screw-threaded into the hub of the fan, the thread being of opposite pitch from the direction of rotation of the fan, whereby the thrust member will not be loosened. The outer end of the thrust member is provided with a squared portion *e′* to which a wrench may be applied for securing it in position or removing it, and with a hardened thrust face or block e^2 adapted to coöperate with a set screw F which is adjustably mounted in a

removable bridge piece G on the fixed hub or spider B, B′. The set screw F is held in adjusted position by a lock nut *f* and provides a ready means whereby wear due to thrust may be compensated for. It may be noted that the thrust faces of the fixed and movable thrust members are preferably flat faces, so as to give a large surface contact and avoid the necessity of accurate centering and balancing, such as would be necessary if point or cone bearings were employed. The outer end of the movable thrust member within the shaft is supported in a bushing E′ and oil is supplied to the hollow shaft, bushings and thrust bearings through an oil duct extending in through the vertical spider arm B′ from an oil cup of ordinary construction mounted on the upper side of the casing.

The fan is usually formed with a relatively wide peripheral flange or rim D′, the outer face of which runs in proximity to the inner face of the cylindrical casing, and projecting from the rim D′ into the channel between the faces of the casing sections, is a radial flange H which may be integral with the rim D′ but is preferably separate therefrom and secured thereto through the instrumentalities of a foot piece *h* and screws or bolts *h′*. Conveniently, the flange H projects parallel with and in proximity to the inner face of the channel formed by the outer section of the casing, and it has attached thereto or formed integral therewith a concentric series of turbine buckets projecting therefrom parallel with the axis of rotation of the fan whereby the steam or elastic propelling fluid is adapted to flow radially out into the exhaust chamber.

In the preferred construction, the turbine buckets are made in sections each embodying but two or three buckets I (see Figs. 5 and 6), an outer or face flange I′, and an inner or base flange of dovetail section as shown at I^2. In addition, each section is provided with a central dovetail projection I^3 on the base. The dovetail projections and flanges are united to the flange H by having the latter cast about them. In practice the flange H is made of one of the aluminum alloys, while the buckets and parts integral therewith are made of gun metal, or one of the bronze alloys which will have high tensile strength and resistance to deterioration under the influences to which it is subjected in use.

By forming the buckets in sections difficulties due to unequal expansion and contraction, are largely overcome, and each section is of light weight whereby liability of destruction due to centrifugal force is reduced.

The buckets are mounted on the flange H a sufficient distance outside of the foot H to form a chamber or channel in which the jet nozzles may be located.

The jet nozzles K are mounted upon or formed integral with couplings L which pass in through rectangular openings in the flange of the casing, as best seen in Figs. 1 and 6, and are adapted to be bolted or secured in place on said casing by screws *l* shown in dotted lines in Fig. 2. Each coupling is in communication with a steam supply pipe M through nipples *m*, said steam supply pipe being branched as shown in dotted lines in Fig. 2, and the ends of the branches provided with drip cocks *m′*. The jets from the nozzles are directed tangentially to strike the buckets at the proper angle for advancing them by impact and reaction in the well understood manner, the steam during its action on the buckets and in escaping therefrom to the exhaust chamber, moving radially out into the said chamber from whence it is free to escape through the exhaust pipe O at one side of the casing, the exhaust being assisted, if so desired, by a supplemental exhaust nozzle P fed through a valve controlled branch *p* from the steam pipe M.

The entry of steam from the nozzles or from the exhaust chamber into the fan area of the casing, is prevented not alone by the close fit between the working faces, but by the centrifugal action which creates a relatively strong outward pressure through between the working faces of the fan flanges and casing, thus the apparatus is well adapted for delivering dry air, although it will be understood of course that under some circumstances the exhaust pipe may be carried around and the steam discharged with the air at any suitable point of delivery.

In the form of the apparatus illustrated in Figs. 1 and 2, the two sections of the casing are adapted to be mounted upon saddles Q on a base plate Q′, preferably so as to be removable therefrom, as shown, and the ends of the casing are adapted for connection with inlet and exhaust pipes Q^2 and Q^3, respectively, this arrangement being particularly useful in a conveyer system where the air is caused to travel in circuit and during its travel through a portion of the circuit to carry with it ashes, cinders, or other matter to be transported from one point to another. In Fig. 3, however, it will be noted that the outer end or section R of the casing, while conforming in other respects to that shown in Figs. 1 and 2, is not adapted for the attachment of a supply pipe, but is somewhat flared and forms the entrance aperture for the air. This construction is particularly well adapted for steam boiler blowers, and in this instance the inner section R′ may be extended in its cylindrical form so as to pass through and

be supported in the ash pit wall. In other respects the two constructions are identical and hence details have been omitted from Fig. 3.

In operation the impact and reaction of the elastic driving fluid sets up a rapid rotation of the fan, and the latter causes the air to travel through the casing. The particular pitch or character of the fan blades is not of importance in so far as the present invention is concerned, but is of course adapted for the speed at which the fan is to be rotated and the volume of air to be handled at that speed of rotation.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. In a turbine driven blower, the combination with a casing having an exterior peripheral exhaust chamber and an annular radial channel opening into the exhaust chamber, of a fan journaled in the casing and having a peripheral flange projecting radially into said channel, turbine buckets on the flange, and jet nozzles on the inner side of the path of travel of the buckets and directed tangentially to cause the elastic driving fluid to travel radially outward substantially parallel with the radial plane of the flange.

2. In a turbine driven blower, the combination with a casing having an exhaust chamber around the outer side of the same and an annular radial channel between the inside of the casing and chamber, of a fan journaled in the casing, a peripheral flange on the fan projecting into the annular radial channel, turbine buckets mounted on the flange and projecting substantially parallel with the axis of rotation of the fan, and jet nozzles on the inner side of the buckets, whereby the elastic driving fluid will flow radially into the exhaust chamber.

3. In a turbine driven blower, the combination with a casing having an annular radial channel at its periphery, of the fan journaled in the casing, a peripheral flange on the fan projecting into the annular radial channel, turbine buckets mounted on the flange and projecting substantially parallel with the axis of rotation of the fan, and jet nozzles mounted in fixed position to direct the jets of impelling fluid in a direction to flow radially through the buckets.

4. In a turbine driven blower, the combination with a casing formed in sections, the meeting faces of said sections forming between them a peripheral radial channel and external exhaust chamber, of a fan journaled on a bearing mounted in one of said sections, a peripheral flange on the fan projecting into the radial channel, turbine buckets carried by the flange, and jet nozzles mounted in the radial plane of the buckets to direct the flow of impelling fluid radially through the buckets into the exhaust chamber.

5. In a turbine driven blower, the combination with a casing formed in sections and having the meeting faces of the sections forming a radial peripheral channel, and an exhaust chamber, of a fan journaled on a bearing supported in one of said sections and having a rim running in proximity to the inner face of the casing, a radial flange mounted on said rim and projecting into the channel, turbine buckets carried by the flange within the channel and projecting substantially parallel with the axis of rotation of the fan, and jet nozzles located on the opposite side of said buckets from the exhaust chamber, whereby the impelling fluid will be caused to travel radially through the buckets and into the exhaust chamber.

6. In a turbine driven blower, the combination with a substantially cylindrical casing having a peripheral channel and exhaust chamber, and an internal spider and hub, of a shaft mounted in said hub, a fan journaled on said shaft and having a peripheral flange projecting into the channel, turbine blades on said flange projecting substantially parallel with the axis of rotation of the fan, jet nozzles in the channel on the inner side of the buckets for directing the impelling fluid outwardly through the buckets into the exhaust chamber, and means for adjusting the position of the fan longitudinally on its axis, whereby the position of the flange and blades in the channel may be regulated.

7. In a turbine driven blower, the combination with a casing formed in sections, the meeting faces of said sections forming between them a peripheral channel and exhaust chamber, and one of said sections having an internal spider and hub, of a shaft supported by said hub, a fan carried by the shaft, a peripheral flange on the fan projecting into the channel between the sections of the casing, turbine buckets mounted on said flange and projecting substantially parallel with the axis of rotation of the fan, jet nozzles projecting in an opposite direction from the buckets on the inner side thereof and directed tangentially outward, and an exhaust pipe connected with the exhaust chamber.

8. In a turbine driven blower, the combination with a casing formed in transverse sections with a peripheral channel between the sections, a fan journaled in a support carried by one of the sections and having a radial flange with turbine buckets thereon projecting into the channel, and jet nozzles carried by the other section, whereby upon separating the sections the fan will be removed from the jet nozzles and steam pipe connections.

9. In a turbine driven blower, the combi-

nation with a casing having an internal fixed spider and hub, a hollow shaft fixed in said hub, a fan journaled on the shaft, and peripheral turbine buckets carried by the fan, of a movable thrust member mounted in the fan and projecting outwardly through the hollow shaft, and a fixed thrust member with which said movable member coöperates mounted on the outer side of the fixed hub.

10. In a turbine driven blower, the combination with a casing having a fixed spider and internal hub therein, the hollow shaft fixed in said hub, the fan driven on said shaft, and the peripheral turbine buckets carried by the fan, of a movable thrust member mounted in the fan and extending outwardly through the hollow shaft, a head on the outer end of said thrust member, a coöperating thrust member adjustable to fixed positions at the outer end of the movable member, and a support for said coöperating thrust member carried by the fixed hub.

11. In a turbine driven blower, the combination with a casing having an internal spider and hub, a hollow shaft fixed in the hub, and a fan journaled on the shaft, of a headed movable thrust member extending through the shaft and separably connected with the fan at its inner end, a bridge carried by the hub at the outer end of the shaft, and a thrust member adjustably mounted in said bridge to coöperate with the movable thrust member on the opposite side of the hub from that on which the fan is mounted.

WILLIAM McCLAVE.

Witnesses:
THOMAS DURANT,
ALEXANDER S. STEUART.